

Improved Estimates of Radiogenic Cancer Risks from Atomic Bomb Survivor Data

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Key Words: radiation, cancer, risk, estimates, A-bomb

Simple methods are investigated for improving estimates of cancer risk from exposure to radiation. These estimates of risk are based on incidence data from the Radiation Effects Research Foundation (RERF) in Japan, whose primary mission is to study the health effects of radiation on survivors of the atomic bomb. Results from the RERF studies serve as a primary basis for the U.S. Environmental Protection Agency radiation risk projections, which are used by federal and state agencies to help implement their radiation protection programs. The RERF estimates of the proportional increase in cancer risk from radiation for solid cancer sites, such as stomach, lung, or liver, have typically been derived separately for each site. However, this approach does not adequately account for possibility that the proportional increase in risk per unit dose may be “similar” among many of the sites. An obvious but unsatisfactory alternative is to set the estimates for each site to a common value. Estimators known as “shrinkage” estimators offer a reasonable compromise between the two approaches. In their simplest form, these estimators, when applied to the A-bomb survivor data, are weighted averages of a pooled overall estimate of the proportional increase in risk and separately derived site-specific estimates. The weights are often determined by the data. These types of estimators have been applied in problems ranging from predicting baseball batting averages to estimates from combining studies on the health effects of exposure to radon. It will be shown how shrinkage estimates might be used to improve estimates of radiogenic risks from the A-bomb studies. This work was done as part of a Beebe Fellowship received from the National Academy of Sciences. This fellowship allowed the author to collaborate with scientists from both RERF and the Radiation Epidemiology Branch of the National Cancer Institute on this project.